DIFFRACTION GRATINGS FOR GRATUITOUS DISTRIBUTION.

TO THE EDITOR OF SCIENCE: Two or three years ago while engaged in some experimental work on the reproduction of diffraction gratings by photography, I devised a method of copying a Rowland 14,000 line to the inch grating, and silvering the copy, transforming it into a reflecting grating. The original was an excellent glass grating kindly loaned to us by the Johns Hopkins University. I was unable to get satisfactory copies with the bichromated gelatine but succeeded very well with albumin. I found this difficulty, however. To reproduce so fine a spacing it was necessary to use an exceedingly thin film, so thin, in fact, that the retardation of the light waves in traversing the 'bars' was insufficient to give spectra of any brilliancy. By thickening the film I was able to get a brilliant grating occasionally, but usually the lines ran together. It then occurred to me to silver the gratings, for the retardation by reflection is four times the retardation by transmission. The thin film failures, which I had thrown into a drawer as scrap plate-glass, were accordingly immersed in a chemical silvering solution, and when washed and dried were found to give brilliant spectra. One of these was exhibited by Professor Boys at a conversazione of the Royal Society about two years ago. Having about thirty of these gratings, which, while not as perfect as an original Rowland grating, being made on ordinary plate glass, are nevertheless suited for the ordinary purposes of the laboratory, I am desirous of placing them where they will do the most good. There must be among our many universities some physical laboratories which are not fortunate enough to have a good diffraction grating. I shall be very glad to distribute these copies to laboratories desiring them, as long as the supply holds out. I shall be glad if applicants will state whether the laboratory possesses a good spectrometer, and also the number of students engaged in the pursuit of physics. Some of the gratings are very good indeed, others quite poor as to general appearance, but all will give tolerably good spectra, and can be used for wave-length determinations. They will show the nickel line between the sodium lines in the solar spectrum very distinctly. Applications from high-schools will not be considered. Failure to receive any reply must be taken as evidence that the supply has been exhausted.

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NOTES ON INORGANIC CHEMISTRY.

ARGON AND ITS COMPANIONS.

ON November 15 a paper was read before the Royal Society by Professor William Ramsay and Dr. Morris W. Travers on 'Argon and its Companions,' which was a continuation of the previous papers of the same authors on the inert gases of the atmosphere. In the early summer of 1898 the discovery of neon and krypton was announced, and later a heavier atmospheric gas was found, to which the name xenon was given. At that time krypton and xenon were not obtained in a condition pure enough for the investigation of their physical constants.

The present paper deals chiefly with these three gases, which have been isolated and studied. By the evaporation of a large amount of liquid air a mixture of argon, krypton and xenon was obtained, the former largely predominating. This mixture was liquefied by liquid air and the three separated by fractional distillation, many times repeated. At the temperature of boiling air krypton has considerable vapor-tension, while that of xenon is scarcely appreciable. Neon was isolated from the first portion of gas escaping from boiling air. This consisted chiefly of nitrogen, which was then liquefied and a part of the liquid evaporated by passing through it a current of air. This gas, after the removal of the oxygen by hot copper, contained most of the helium and neon present in the air. After purification from nitrogen in the usual manner, the helium and neon were separated from the argon present by fractional distillation. To separate these gases was very difficult, but was finally accomplished by condensing the neon by means of boiling hydrogen. In this way pure neon was obtained.

A determination of the ratio of the specific heats of these gases showed that they are all monatomic. A number of the physical prop-

erties of these gases were determined, which are given in the following table:

	Helium.	Neon.	Argon.	Krypton	Xenon.
Refractivities (Air 1)	0.1238	0.2345	0.968	1.449	2.364
Densities of gases (O=16)	1.98	9.97	19.96	40.88	64
Boiling points at 760 mm	?	?	86.9° abs.	121.33° abs.	163.9° abs.
Critical temperatures	?	Below 68° abs.	155.6° abs.	210.5° abs.	287.7° abs.
Critical pressures	?	?	40.2 m.	41.24 m.	43.5 meters.
Vapor-pressure ratio	?	?	0.0350	0.0467	0.0675
Weight of 1 cc. of liquid	?	?	1.212 gms.	2.155 gms.	3.52 gms.
Molecular volume	?	?	32.92	37.84	36.40

In the vacuum tube neon is extremely brilliant and of an orange-pink hue, and is characterized by multitude of intense orange and yellow lines; krypton is pale violet, and xenon is sky-blue.

The five elements clearly form a series in the periodic table, between the seventh and the first groups, that is, as a transition from the most negative to the most positive group. This is of the greatest interest, since in two recently published papers Ladenburg has given the atomic weight of krypton as about 59, placing the element between nickel and copper. It could thus find no place in the periodic table, as it is now understood. On the other hand, as determined by Ramsay and Travers, the elements find a natural place in the eighth group, as a transition from the negative series of the seventh group to the positive series of the first group.

J. L. H.

THE RESIGNATION OF PRESIDENT MENDENHALL.

MEN of science everywhere will learn with deep regret that Dr. Thomas C. Mendenhall has been compelled by ill health to resign the presidency of the Worcester Polytechnic Institute. Fortunately President Mendenhall's health has only been injured by the great amount and responsible character of the work he has undertaken, and there is every reason to believe that after rest in Europe he will return prepared to continue work as important as that which he has already accomplished at the Ohio State University, the Imperial University of Japan, the U. S. Signal Service, the Rose Polytechnic Institute, the U. S. Coast and Geodetic Survey and the Worcester Polytechnic Institute. It is known to all men of science that, while occupying executive positions of great responsibility, President Mendenhall has carried out scientific researches of the utmost importance, and has taken an active part in all movements for the advancement and diffusion of science in the United States. He is one of the most efficient members of the National Academy of Sciences and of the American Association for the Advancement of Science, of which he has been president. He is now president of the American Metrological Society, chairman of the Massachusetts Highway Commission and a leader in many important scientific movements. As one of the editors of this journal since its reorganization six years ago his services have been invaluable. The grounds of President Mendenhall's resignation, the reluctance with which it was accepted and the great value of his work at the Worcester Polytechnic Institute is shown by the following letters. The letter of resignation, dated October 15, 1900, is as follows:

Hon. Stephen Salisbury,
President, Board of Trustees.
Worcester Polytechnic Institute:

Dear Sir:

I hereby tender my resignation as president of the Worcester Polytechnic Institute, to take effect on the first of July next.

I send this communication so long in advance in order to afford ample time for the selection of a suitable person to fill my place, and I hope I may be allowed to add a few words in acknowledgment of the continued and unvarying kindness which the board of trustees have shown me during my connection with the institute.

As far as I can now remember every suggestion I have made relating to the management of the institute has been approved by the board and every plan for its betterment that I have submitted has received its cordial, unanimous and hearty support. My personal relations with the members of the board have been, without exception, agreeable; everything that they could do to make my administration successful and my life in Worcester pleasant has been done, and I cannot give measure, however much I might multiply words, to the feelings of appreciation and grati-